

## 2.2 Shielding

Shielding against terrestrial interference has proved successful in some cases. Fences, buildings, trees and shrubs, as well as natural or artificial berms have been used effectively. However, experience has indicated that less than half of the TVRO's can be protected in this manner.

## 2.3 Interference Mechanism

In Figure 2, the spectral mask of a full transponder carrying television is shown along with the spectral mask of a terrestrial 4 GHz microwave signal. As is the case under current plans, the center frequencies of the spectra are 10 MHz apart. A satellite receiver with a nominal bandwidth of 30 MHz will "see" both spectra. The peak amplitudes are shown as equal only for purposes of illustration. If the amplitude of the terrestrial carrier is stronger than 10 dB below the satellite carrier, visual harmful interference will be seen in the TV picture produced by the satellite receiver and TV set. The interference shows up as "sparkles" throughout the picture on virtually every active line of the raster.

#### 2.4 Terrestrial Interference Filters

The TVRO industry has found a way to eliminate the objectionable interference by utilizing the fact that the center frequency of the terrestrial carriers are exactly 10 MHz from the center frequency of a desired satellite carrier operating in the FM/TV mode of modulation. Band reject filters are used as shown in Figure 3. Figure 3 shows a filter employed at 3730 MHz, but they can be installed anywhere in the down converted chain at any intermediate frequency (IF).

Early TVRO's used external filters, but filter use is so pervasive that virtually all modern receivers contain the TI filters and are switch selectable. These filters reduce the level of the interference at the demodulator by as much as 30 dB. Therefore, they are effective in virtually all cases.

In performing the interference rejection function, the predetection bandwidth of the receiver is reduced, and phase nonlinearities are introduced in the transmission path. As a result, this narrowing of the receiver bandwidth due to the filter is accompanied by some degradation of the TV picture as ultimately viewed. Several performance parameters are degraded, but the end result is acceptable. The major effect

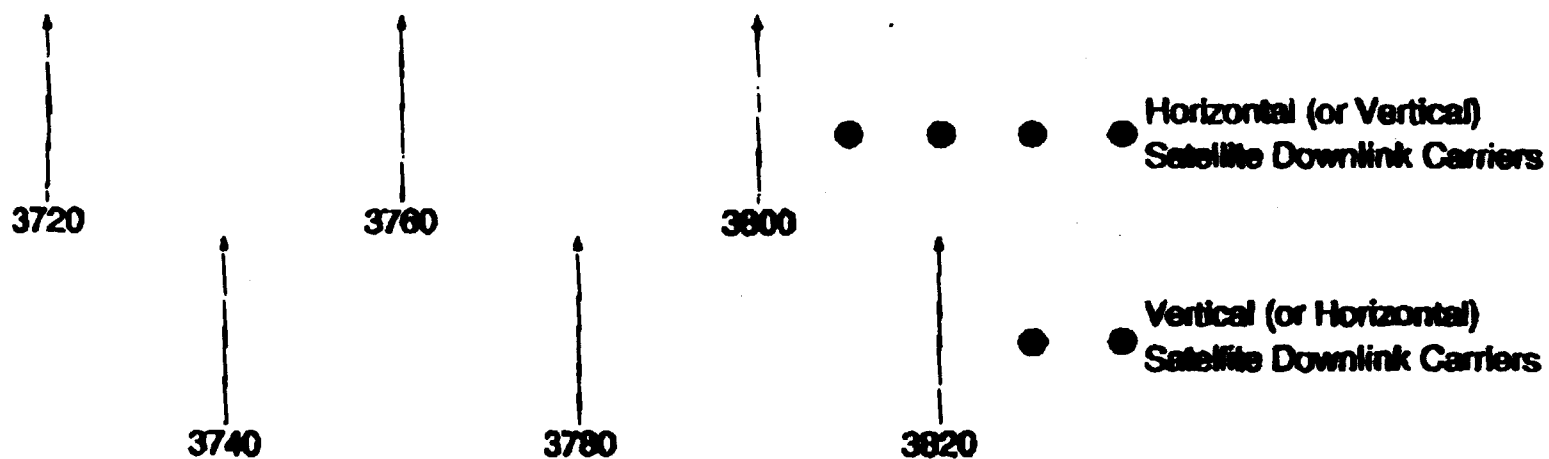
is a very slight loss of resolution, and a washed out color content. The color content is usually restored by adjusting the color adjustments in the TV set.

### **3 NARROWBAND TERRESTRIAL CARRIERS**

Should narrowband terrestrial carriers be allowed in the 3700 to 4200 MHz band, as proposed in the FNPRM under consideration, the TI filters would be ineffective. The narrowband carriers could appear anywhere in the satellite receiver passband. All of the 400 kHz and 800 kHz bandwidth ones are less than 5 MHz from the center of a satellite channel. Fifteen (out of 24) of the 1.6 MHz bandwidth carriers and 3 (out of 6) of the 5 MHz bandwidth carriers are also within 5 MHz of the center of a satellite channel. The 400kHz, 800kHz, 1.6MHz, and 5MHz bandwidth channels therefore have the potential for interference to 4 satellite TV channels. All of the 10 Mhz bandwidth channels are 5 MHz from the center of a satellite channel. The 10MHz bandwidth channels therefore have the potential for interference to all of the satellite channels. Filters cannot be effective with interfering carriers only 5 MHz from the center of a satellite channel. The quality of the television signal would not be acceptable. In effect, all satellite transponders could be unavailable to the home and educational users of satellite services.

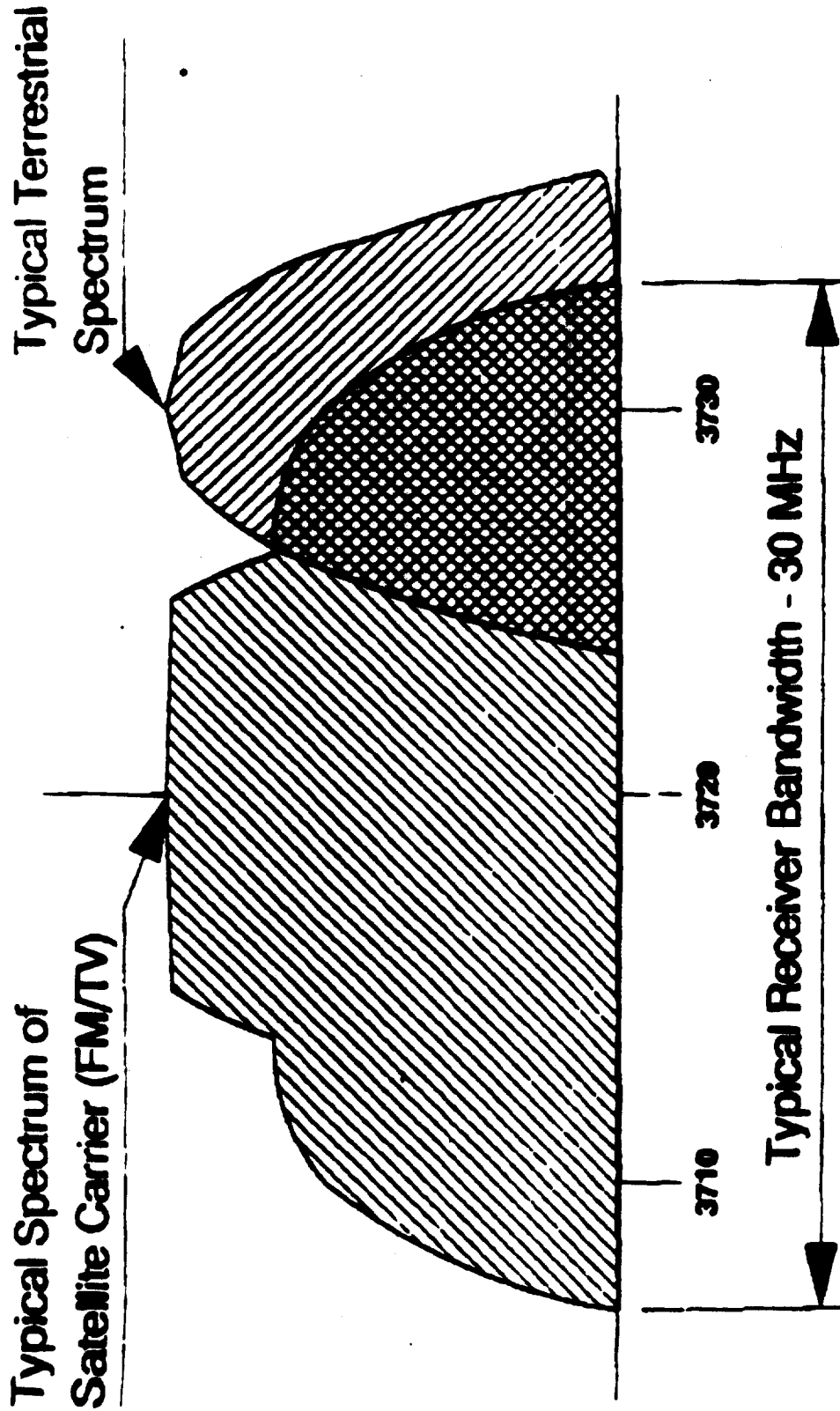


**a. Partial Frequency Plan for 4 GHz Terrestrial Systems**



**b. Partial Frequency Plan for 4 GHz Satellite Systems**

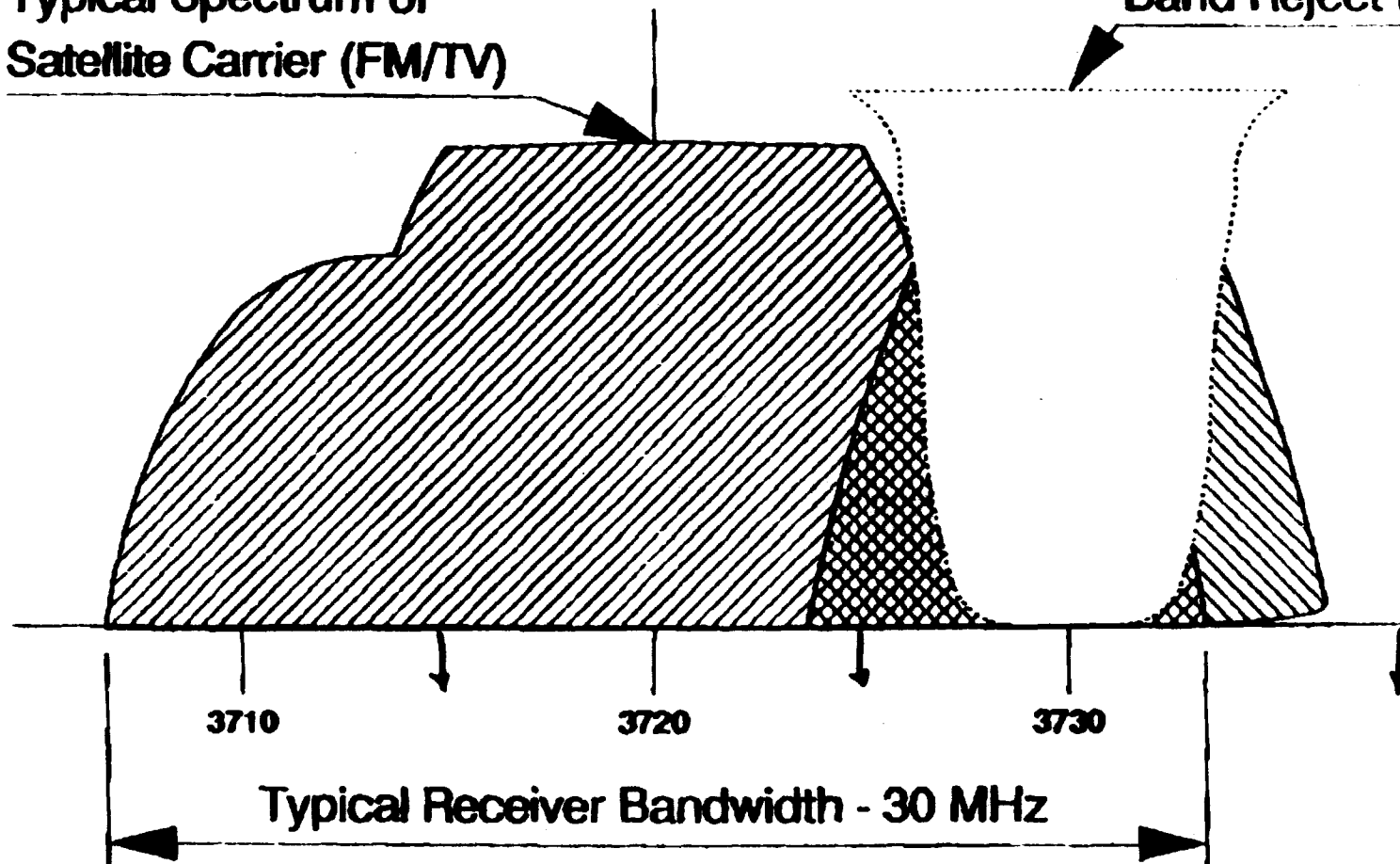
**FIGURE 1 - CENTER FREQUENCY ASSIGNMENTS FOR TERRESTRIAL AND SATELLITE CHANNELS SHOWING INTERLEAVING OF ASSIGNMENTS**



**FIGURE 2 - CONVOLUTION OF SATELLITE (FM/TV) AND TERRESTRIAL CARRIERS**

Typical Spectrum of  
Satellite Carrier (FM/TV)

Band Reject Filter



**FIGURE 3 - BAND REJECT FILTER REDUCES  
TERRESTRIAL INTERFERENCE**

## DECLARATION OF NORMAN WEINHOUSE

My name is Norman P. Weinhouse. I am the owner of Norman Weinhouse Associates, a telecommunications consulting firm. I have over 40 years experience in the field of microwave and satellite communications. A brief background sheet is attached.

I have examined the Commission's Further Notice of Proposed Rule-making, In the Matter of Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies, (ET Docket No. 92-9, RM-8004 and RM-7981). Based on the Commission's proposed rechannelization and other information presented in the foregoing technical discussion, I have analyzed the effect the proposed rechannelization will have on current users of the 3700 to 4200 MHz Band. I have determined that such rechannelization can cause severe interference to current users. I have prepared the foregoing technical discussion, and I declare under penalty of perjury that the foregoing technical discussion is true and correct.

A handwritten signature in cursive script that reads "Norman P. Weinhouse". The signature is written in dark ink and is positioned above a solid horizontal line.

Dated: December 1, 1992    Norman P. Weinhouse

## **NORMAN P. WEINHOUSE**

Founder/owner of Norman Weinhouse Associates, an engineering consulting firm.

Norm Weinhouse is a prominent consultant to users and operators in the satellite and terrestrial communications industry with a specialty in the television field. He has served on many industry committees establishing standards for microwave and satellite transmissions. He is currently chairman of the Satellite Practices subcommittee of the NCTA Engineering Committee. Weinhouse Associates' client list includes many programmers and satellite operators as well as important users of satellite and microwave for data, voice, audio and television services. In recent years the firm's work involves digital technologies utilizing compression and spectrally efficient modulation techniques.

Prior to establishing his own firm in 1984, Weinhouse was with Hughes Aircraft Company for 16 years. He had various engineering management positions including design responsibility for a wide variety of satellite earth stations including TT&C, as well as general purpose communication stations and TVRO's. Weinhouse joined Hughes Communications, Inc. (a subsidiary of Hughes Aircraft) in 1981 and was Systems Engineering Manager, and Technology Manager for the Galaxy satellite fleet.

Previous employment included eight years (1960-1968) at Rantec Corporation where Weinhouse had responsibility for a sophisticated microwave test equipment product line. From 1953 to 1960 Weinhouse was with Collins Radio where he was a key designer and system engineer for a terrestrial microwave product line. From 1949 to 1953 he was a microwave circuit design engineer at Motorola, Inc.

Weinhouse is a graduate of the University of Illinois (with honors) and holds a MSEE from Northwestern University. He is a senior member of IEEE, a member of SMPTE, and SCTE.